

SEQUENCE LISTING

Assignment of SEQ ID NOS

	SEQ ID NO 1	acetoacetyl-CoA thiolase nucleotide sequence
5	SEQ ID NO 2	HMG-CoA synthase nucleotide sequence
	SEQ ID NO 3	HMG-CoA reductase nucleotide sequence
	SEQ ID NO 4	mevalonate kinase nucleotide sequence
	SEQ ID NO 5	phosphomevalonate kinase nucleotide sequence
	SEQ ID NO 6	mevalonate pyrophosphate decarboxylase nucleotide sequence
10	SEQ ID NO 7	"single operon" nucleotide sequence
	SEQ ID NO 8	"MEVT" operon nucleotide sequence
	SEQ ID NO 9	"MEVB" operon nucleotide sequence (not including the transcription terminator)
	SEQ ID NO 10	Isopentenyl pyrophosphate isomerase (<i>idi</i>) nucleotide sequence
15	SEQ ID NO 11	Farnesyl pyrophosphate synthase (<i>ispA</i>) nucleotide sequence
	SEQ ID NO 12	"MBI" operon nucleotide sequence ^F
	SEQ ID NO 13	"MBIS" operon nucleotide sequence

SEQ ID NO 1 Acetoacetyl-CoA thiolase nucleotide sequence

1 ATGAAAAATT GTGTCATCGT CAGTGCGGTA CGTACTGCTA TCGGTAGTTT TAACGGTTCA
61 CTCGCTTCCA CCAGCGCCAT CGACCTGGGG GCGACAGTAA TTAAAGCCGC CATTGAACGT
121 GCAAAAATCG ATTCACAACA CGTTGATGAA GTGATTATGG GTAACGTGTT ACAAGCCGGG
25 181 CTGGGGCAAA ATCCGGCGCG TCAGGCACTG TTAAGAGCG GGCTGGCAGA AACGGTGTGC
241 GGATTCACGG TCAATAAAGT ATGTGGTTCG GGTCTTAAAA GTGTGGCGCT TGCCGCCAG
301 GCCATTCAGG CAGGTCAGGC GCAGAGCATT GTGGCGGGGG GTATGGAAAA TATGAGTTTA
361 GCCCCCTACT TACTCGATGC AAAAGCACGC TCTGGTTATC GTCTTGAGA CGGACAGTTT
421 TATGACGTAA TCCTGCGCGA TGGCCTGATG TGCGCCACCC ATGGTTATCA TATGGGGATT
30 481 ACCGCCGAAA ACGTGGCTAA AGAGTACGGA ATTACCCGTG AAATGCAGGA TGAAGTGGCG
541 CTACATTAC AGCGTAAAGC GGCAGCCGCA ATTGAGTCCG GTGCTTTTAC AGCCGAAATC
601 GTCCCGGTAA ATGTTGTCAC TCGAAAGAAA ACCTTCGTCT TCAGTCAAGA CGAATTCCCC

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661 AAAGCGAATT CAACGGCTGA AGCGTTAGGT GCATTGCGCC CGGCCTTCGA TAAAGCAGGA
721 ACAGTCACCG CTGGGAACGC GTCTGGTATT AACGACGGTG CTGCCGCTCT GGTGATTATG
781 GAAGAATCTG CGGCGCTGGC AGCAGGCCTT ACCCCCCTGG CTCGCATTAA AAGTTATGCC
841 AGCGGTGGCG TGCCCCCGC ATTGATGGGT ATGGGGCCAG TACCTGCCAC GCAAAAAGCG
901 TTACAACTGG CGGGGCTGCA ACTGGCGGAT ATTGATCTCA TTGAGGCTAA TGAAGCATTT
961 GCTGCACAGT TCCTTGCCGT TGGGAAAAAC CTGGGCTTTG ATTCTGAGAA AGTGAATGTC
1021 AACGGCGGGG CCATCGCGCT CGGGCATCCT ATCGGTGCCA GTGGTGCTCG TATTCTGGTC
1081 AACTATTAC ATGCCATGCA GGCACGCGAT AAAACGCTGG GGCTGGCAAC ACTGTGCATT
1141 GGCGGCGGTC AGGGAATTGC GATGGTGATT GAACGGTTGA ATTAA

SEQ ID NO 2 HMG-CoA synthase nucleotide sequence

1 ATGAACTCT CAACTAACT TTGTTGGTGT GGTATTAAAG GAAGACTTAG GCCGAAAAG
61 CAACAACAAT TACACAATAC AAACCTTGCAA ATGACTGAAC TAAAAAACA AAAGACCGCT
121 GAACAAAAA CCAGACCTCA AAATGTCGGT ATTAAAGGTA TCCAAATTTA CATCCCAACT
181 CAATGTGTCA ACCAATCTGA GCTAGAGAAA TTTGATGGCG TTTCTCAAGG TAAATACACA
241 ATTGGTCTGG GCCAAACCAA CATGTCTTTT GTCAATGACA GAGAAGATAT CTAATCGATG
301 TCCCTAACTG TTTTGTCTAA GTTGATCAAG AGTTACAACA TCGACACCAA CAAAATTGGT
361 AGATTAGAAG TCGGTACTGA AACTCTGATT GACAAGTCCA AGTCTGTCAA GTCTGTCTTG
421 ATGCAATTGT TTGGTGAAAA CACTGACGTC GAAGGTATTG ACACGCTTAA TGCTGTCTTG
481 GGTGGTACCA ACGCGTTGTT CAACTCTTTG AACTGGATTG AATCTAACGC ATGGGATGGT
541 AGAGACGCCA TTGTAGTTTG CGGTGATATT GCCATCTACG ATAAGGGTGC CGCAAGACCA
601 ACCGGTGGTG CCGGTACTGT TGCTATGTGG ATCGGTCCTG ATGCTCCAAT TGTATTTGAC
661 TCTGTAAGAG CTTCTTACAT GGAACACGCC TACGATTTTT ACAAGCCAGA TTTCACCAGC
721 GAATATCCTT ACGTCGATGG TCATTTTTCA TTAACCTGTT ACGTCAAGGC TCTTGATCAA
781 GTTTACAAGA GTTATTCCAA GAAGGCTATT TCTAAAGGGT TGGTTAGCGA TCCCGCTGGT
841 TCGGATGCTT TGAACGTTTT GAAATATTTT GACTACAACG TTTTCCATGT TCCAACCTGT
901 AAATTGGTCA CAAAATCATA CGGTAGATTA CTATATAACG ATTTTCAGAGC CAATCCTCAA
961 TTGTTCCAG AAGTTGACGC CGAATTAGCT ACTCGCGATT ATGACGAATC TTTAACCAGT
1021 AAGAACATTG AAAAACTTT TGTTAATGTT GCTAAGCCAT TCCACAAAGA GAGAGTTGCC
1081 CAATCTTTGA TTGTTCCAAAC AAACACAGGT AACATGTACA CCGCATCTGT TTATGCCGCC
1141 TTTGCATCTC TATTAACTA TGTGATCT GACGACTTAC AAGGCAAGCG TGTTGGTTTA
1201 TTTTCTTACG GTTCCGTTT AGCTGCATCT CTATATTCTT GCAAAATTGT TGGTGACGTC
1261 CAACATATTA TCAAGGAATT AGATATTACT AACAAATTAG CCAAGAGAAT CACCGAACT
1321 CCAAAGGATT ACGAAGCTGC CATCGAATTG AGAGAAAATG CCCATTTGAA GAAGAAGTTC
1381 AAACCTCAAG GTTCCATTGA GCATTTGCAA AGTGGTGTTT ACTACTTGAC CAACATCGAT

1441 GACAAATTTA GAAGATCTTA CGATGTTAAA AAATAA

SEQ ID NO 3 Truncated HMG-CoA reductase nucleotide sequence

Artificial Start Codon

1 ATGGTTTTTAA CCAATAAAAC AGTCATTTCT GGATCGAAAAG TCAAAAGTTT ATCATCTGCG

↑
Base Pair 1660 of *S.cervisiae* *HMG1*

61 CAATCGAGCT CATCAGGACC TTCATCATCT AGTGAGGAAG ATGATTCCCG CGATATTGAA
121 AGCTTGGATA AGAAAATACG TCCTTTAGAA GAATTAGAAG CATTATTAAG TAGTGGAAAT
181 ACAAACAAT TGAAGAACA AGAGGTCGCT GCCTTGGTTA TTCACGGTAA GTTACCTTTG
241 TACGCTTTGG AGAAAAATT AGGTGATACT ACGAGAGCGG TTGCGGTACG TAGGAAGGCT
301 CTTTCAATTT TGGCAGAAGC TCCTGTATTA GCATCTGATC GTTTACCATA TAAAAATTAT
361 GACTACGACC GCGTATTTGG CGCTTGTTGT GAAAATGTTA TAGGTTACAT GCCTTTGCCC
421 GTTGGTGTTA TAGGCCCTT GGTATCGAT GGTACATCTT ATCATATACC AATGGCAACT
481 ACAGAGGGTT GTTTGGTAGC TTCTGCCATG CGTGGCTGTA AGGCAATCAA TGCTGGCGGT
541 GGTGCAACAA CTGTTTTAAC TAAGGATGGT ATGACAAGAG GCCCAGTAGT CCGTTTCCCA
601 ACTTTGAAAA GATCTGGTGC CTGTAAGATA TGGTTAGACT CAGAAGAGGG ACAAACGCA
661 ATTAAAAAAG CTTTTAACTC TACATCAAGA TTTGCACGTC TGCAACATAT TCAAATTGT
721 CTAGCAGGAG ATTTACTCTT CATGAGATTT AGAACAATA CTGGTGACGC AATGGGTATG
781 AATATGATTT CTAAAGGTGT CGAATACTCA TTAAAGCAA TGGTAGAAGA GTATGGCTGG
841 GAAGATATGG AGGTTGTCTC CGTTTCTGGT AACTACTGTA CCGACAAAA ACCAGCTGCC
901 ATCAACTGGA TCGAAGGTCG TGGTAAGAGT GTCGTCGCAG AAGCTACTAT TCCTGGTGAT
961 GTTGTGAGAA AAGTGTTAAA AAGTGATGTT TCCGCATTGG TTGAGTTGAA CATTGCTAAG
1021 AATTTGGTTG GATCTGCAAT GGCTGGGTCT GTTGGTGGAT TTAACGCACA TGCAGCTAAT
1081 TTAGTGACAG CTGTTTCTT GGCATTAGGA CAAGATCCTG CACAAAATGT TGAAAGTTCC
1141 AACTGTATAA CATTGATGAA AGAAGTGGAC GGTGATTTGA GAATTTCCGT ATCCATGCCA
1201 TCCATCGAAG TAGGTACCAT CGGTGGTGGT ACTGTTCTAG AACCACAAGG TGCCATGTTG
1261 GACTTATTAG GTGTAAGAGG CCCGCATGCT ACCGCTCCTG GTACCAACGC ACGTCAATTA
1321 GCAAGAATAG TTGCCTGTGC CGTCTTGGCA GGTGAATTAT CCTTATGTGC TGCCCTAGCA
1381 GCCGGCCATT TGGTTCAAAG TCATATGACC CACAACAGGA AACCTGCTGA ACCAACAAAA
1441 CCTAACAATT TGGACGCCAC TGATATAAAT CGTTTGAAAG ATGGGTCCGT CACCTGCATT
1501 AAATCCTAA

SEQ ID NO 4 Mevalonate kinase nucleotide sequence

1 ATGTCATTAC CGTTCTTAAC TTCTGCACCG GGAAAGGTTA TTATTTTGG TGAACACTCT
61 GCTGTGTACA ACAAGCCTGC CGTCGCTGCT AGTGTGTCTG CGTTGAGAAC CTACCTGCTA
121 ATAAGCGAGT CATCTGCACC AGATACTATT GAATTGGACT TCCCGGACAT TAGCTTTAAT
181 CATAAGTGGT CCATCAATGA TTTCAATGCC ATCACCGAGG ATCAAGTAAA CTCCCAAAAA
241 TTGGCCAAGG CTCAACAAGC CACCGATGGC TTGTCTCAGG AACTCGTTAG TCTTTTGGAT
301 CCGTTGTTAG CTCAACTATC CGAATCCTTC CACTACCATG CAGCGTTTTG TTTCTGTAT
361 ATGTTTGTTC GCCTATGCCC CCATGCCAAG AATATTAAGT TTTCTTTAAA GTCTACTTTA
421 CCCATCGGTG CTGGGTTGGG CTCAAGCGCC TCTATTTCTG TATCACTGGC CTTAGCTATG
481 GCCTACTTGG GGGGGTTAAT AGGATCTAAT GACTTGAAA AGCTGTCAGA AAACGATAAG
541 CATATAGTGA ATCAATGGGC CTTCATAGGT GAAAAGTGTA TTCACGGTAC CCCTTCAGGA
601 ATAGATAACG CTGTGGCCAC TTATGGTAAT GCCCTGCTAT TTGAAAAAGA CTCACATAAT
661 GGAACAATAA ACACAAACAA TTTTAAGTTC TTAGATGATT TCCCAGCCAT TCCAATGATC
721 CTAACCTATA CTAGAATTCC AAGGTCTACA AAAGATCTTG TTGCTCGCGT TCGTGTGTTG
781 GTCACCGAGA AATTTCTGA AGTTATGAAG CCAATTCTAG ATGCCATGGG TGAATGTGCC
841 CTACAAGGCT TAGAGATCAT GACTAAGTTA AGTAAATGTA AAGGCACCGA TGACGAGGCT
901 GTAGAACTA ATAATGAACT GTATGAACAA CTATTGGAAT TGATAAGAAT AAATCATGGA
961 CTGCTTGTCT CAATCGGTGT TTCTCATCCT GGATTAGAAC TTATTAAAAA TCTGAGCGAT
1021 GATTTGAGAA TTGGCTCCAC AAAAATTACC GGTGCTGGTG GCGGCGGTTG CTCTTTGACT
1081 TTGTTACGAA GAGACATTAC TCAAGAGCAA ATTGACAGCT TCAAAAAGAA ATTGCAAGAT
1141 GATTTTAGTT ACGAGACATT TGAAACAGAC TTGGGTGGGA CTGGCTGCTG TTTGTTAAGC
1201 GCAAAAAATT TGAATAAAGA TCTTAAATC AAATCCCTAG TATTCCAATT ATTTGAAAAT
1261 AAAACTACCA CAAAGCAACA AATTGACGAT CTATTATTGC CAGGAAACAC GAATTTACCA
1321 TGGACTTCAT AG

SEQ ID NO 5 Phosphomevalonate kinase nucleotide sequence

1 ATGTCAGAGT TGAGAGCCTT CAGTGCCCCA GGGAAAGCGT TACTAGCTGG TGGATATTTA
61 GTTTTAGATA CAAAATATGA AGCATTTGTA GTCGGATTAT CGGCAAGAAT GCATGCTGTA
121 GCCCATCCTT ACGGTTTCATT GCAAGGGTCT GATAAGTTTG AAGTGCGTGT GAAAAGTAAA
181 CAATTTAAAG ATGGGGAGTG GCTGTACCAT ATAAGTCCTA AAAGTGGCTT CATTCTGT
241 TCGATAGGCG GATCTAAGAA CCCTTTCATT GAAAAAGTTA TCGCTAACGT ATTTAGCTAC
301 TTAAACCTA ACATGGACGA CTACTGCAAT AGAACTTGT TCGTTATTGA TATTTTCTCT
361 GATGATGCCT ACCATTCTCA GGAGGATAGC GTTACCGAAC ATCGTGGCAA CAGAAGATTG
421 AGTTTTTCATT CGCACAGAAT TGAAGAAGTT CCCAAAACAG GGCTGGGCTC CTCGGCAGGT
481 TTAGTCACAG TTTTAACTAC AGCTTTGGCC TCCTTTTTTG TATCGGACCT GGAAAATAAT
541 GTAGACAAAT ATAGAGAAGT TATTCATAAT TTAGCACAAG TTGCTCATTG TCAAGCTCAG

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601 GGTA AAATTG GAAGCGGGTT TGATGTAGCG GCGGCAGCAT ATGGATCTAT CAGATATAGA
661 AGATTCCCAC CCGCATTAAAT CTCTAATTTG CCAGATATTG GAAGTGCTAC TTACGGCAGT
721 AAAGTGGCGC ATTTGGTTGA TGAAGAAGAC TGGAAATATTA CGATTAAAAAG TAACCATTTA
781 CCTTCGGGAT TAAC TTTATG GATGGGCGAT ATTAAGAATG GTTCAGAAAC AGTAAACTG
841 GTCCAGAAGG TAAAAAATTG GTATGATTCG CATATGCCAG AAAGCTTGAA AATATATACA
901 GAACTCGATC ATGCAAATTC TAGATTTATG GATGGACTAT CTAAACTAGA TCGCTTACAC
961 GAGACTCATG ACGATTACAG CGATCAGATA TTTGAGTCTC TTGAGAGGAA TGACTGTACC
1021 TGTCAAAAGT ATCCTGAAAT CACAGAAGTT AGAGATGCAG TTGCCACAAAT TAGACGTTCC
1081 TTTAGAAAAA TAACTAAAGA ATCTGGTGCC GATATCGAAC CTCCCGTACA AACTAGCTTA
1141 TTGGATGATT GCCAGACCTT AAAAGGAGTT CTTACTTGCT TAATACCTGG TGCTGGTGGT
1201 TATGACGCCA TTGCAGTGAT TACTAAGCAA GATGTTGATC TTAGGGCTCA AACCGCTAAT
1261 GACAAAAGAT TTTCTAAGGT TCAATGGCTG GATGTAATC AGGCTGACTG GGGTGTTAGG
1321 AAAGAAAAAG ATCCGGAAAC TTATCTTGAT AAATAG

SEQ ID NO 6 Mevalonate pyrophosphate decarboxylase nucleotide sequence

1 ATGACCGTTT ACACAGCATC CGTTACCGCA CCCGTCAACA TCGCAACCCT TAAGTATTGG
61 GGGAAAAGGG ACACGAAGTT GAATCTGCCC ACCAATTCGT CCATATCAGT GACTTTATCG
121 CAAGATGACC TCAGAACGTT GACCTCTGCG GCTACTGCAC CTGAGTTTGA ACGCGACACT
181 TTGTGGTTAA ATGGAGAACC ACACAGCATC GACAATGAAA GAACTCAAAA TTGTCTGCGC
241 GACCTACGCC AATTAAGAAA GGAAATGGAA TCGAAGGACG CCTCATTGCC CACATTATCT
301 CAATGGAAAC TCCACATTGT CTCCGAAAAT AACTTTCCTA CAGCAGCTGG TTTAGCTTCC
361 TCCGCTGCTG GCTTTGCTGC ATTGGTCTCT GCAATTGCTA AGTTATACCA ATTACCACAG
421 TCAACTTCAG AAATATCTAG AATAGCAAGA AAGGGGTCTG GTTCAGCTTG TAGATCGTTG
481 TTTGGCGGAT ACGTGGCCTG GGAAATGGGA AAAGCTGAAG ATGGTCATGA TTCCATGGCA
541 GTACAAATCG CAGACAGCTC TGA CTG GCGCT CAGATGAAAG CTTGTGTCCT AGTTGTCAGC
601 GATATTAAAA AGGATGTGAG TTCCACTCAG GGTATGCAAT TGACCGTGGC AACCTCCGAA
661 CTATTTAAAG AAAGAATTGA ACATGTCGTA CCAAAGAGAT TTGAAGTCAT GCGTAAAGCC
721 ATTGTTGAAA AAGATTTGCG CACCTTTGCA AAGGAAACAA TGATGGATTG CAACTCTTTC
781 CATGCCACAT GTTTGGACTC TTTCCCTCCA ATATTCTACA TGAATGACAC TTCCAAGCGT
841 ATCATCAGTT GGTGCCACAC CATTAATCAG TTTTACGGAG AAACAATCGT TGCATACACG
901 TTTGATGCAG GTCCAAATGC TGTGTTGTAC TACTTAGCTG AAAATGAGTC GAAACTCTTT
961 GCATTTATCT ATAAATTGTT TGGCTCTGTT CCTGGATGGG ACAAGAAATT TACTACTGAG
1021 CAGCTTGAGG CTTTCAACCA TCAATTTGAA TCATCTAACT TTACTGCACG TGAATTGGAT
1081 CTTGAGTTGC AAAAGGATGT TGCCAGAGTG ATTTTAACTC AAGTCGGTTC AGGCCACAA
1141 GAAACAAACG AATCTTTGAT TGACGCAAAG ACTGGTCTAC CAAAGGAATA A

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SEQ ID NO 7 "single operon" nucleotide sequence

P_{BAD} Promoter

1 GACGCTTTTT ATCGCAACTC TCTACTGTTT CTCCATACCC GTTTTTTTGG GCTAGCAGGA

5

RBS

Start Isopentyl

61 GGAATTCACC ATGGTACCCG GGAGGAGGAT TACTATATGC AAACGGAACA CGTCATTTTA

Pyrophosphate Isomerase

10

121 TTGAATGCAC AGGGAGTTCC CACGGGTACG CTGGAAAAGT ATGCCGCACA CACGGCAGAC

181 ACCCGCTTAC ATCTCGCGTT CTCCAGTTGG CTGTTTAATG CCAAAGGACA ATTATTAGTT

241 ACCCGCCGCG CACTGAGCAA AAAAGCATGG CCTGGCGTGT GGACTAACTC GGTTTGTGGG

301 CACCCACAAC TGGGAGAAAG CAACGAAGAC GCAGTGATCC GCCGTTGCCG TTATGAGCTT

361 GGCGTGAAAA TTACGCCTCC TGAATCTATC TATCCTGACT TTCGCTACCG CGCCACCGAT

421 CCGAGTGGCA TTGTGGAAAA TGAAGTGTGT CCGGTATTTG CCGCACGCAC CACTAGTGCG

15

481 TTACAGATCA ATGATGATGA AGTGATGGAT TATCAATGGT GTGATTTAGC AGATGTATTA

541 CACGGTATTG ATGCCACGCC GTGGGCGTTC AGTCCGTGGA TGGTGATGCA GGCGACAAAT

End Isopentyl Pyrophosphate Isomerase

20

601 CGCGAAGCCA GAAAACGATT ATCTGCATTT ACCCAGCTTA AATAACCCGG GGATCCTCTA

RBS

Start Acetoacetyl-CoA Thiolase

25

661 GAGTCGACTA GGAGGAATAT AAAATGAAAA ATTGTGTCAT CGTCAGTGCG GTACGTACTG

721 CTATCGGTAG TTTTAACGGT TCACTCGCTT CCACCAGCGC CATCGACCTG GGGGCGACAG

781 TAATTAAAGC CGCCATTGAA CGTGCAAAAA TCGATTACACA ACACGTTGAT GAAGTGATTA

841 TGGGTAACGT GTTACAAGCC GGGCTGGGGC AAAATCCGGC GCGTCAGGCA CTGTTAAAAA

901 GCGGGCTGGC AGAAACGGTG TGCGGATTCA CCGTCAATAA AGTATGTGGT TCGGGTCTTA

961 AAAGTGTGGC GCTTGCCGCC CAGGCCATTC AGGCAGGTCA GGCGCAGAGC ATTGTGGCGG

1021 GGGGTATGGA AAATATGAGT TTAGCCCCCT ACTTACTCGA TGCAAAAGCA CGCTCTGGTT

30

1081 ATCGTCTTGG AGACGGACAG GTTTATGACG TAATCCTGCG CGATGGCCTG ATGTGCGCCA

1141 CCCATGGTTA TCATATGGGG ATTACCGCCG AAAACGTGGC TAAAGAGTAC GGAATTACCC

1201 GTGAAATGCA GGATGAACTG GCGCTACATT CACAGCGTAA AGCGGCAGCC GCAATTGAGT

1261 CCGGTGCTTT TACAGCCGAA ATCGTCCCGG TAAATGTTGT CACTCGAAAG AAAACCTTCG

1321 TCTTCAGTCA AGACGAATTC CCGAAAGCGA ATTCAACGGC TGAAGCGTTA GGTGCATTGC

35



1381 GCCCGGCCTT CGATAAAGCA GGAACAGTCA CCGCTGGGAA CGCGTCTGGT ATTAACGACG

1441 GTGCTGCCGC TCTGGTGATT ATGGAAGAAT CTGCGGCGCT GGCAGCAGGC CTTACCCCCC


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1501 TGGCTCGCAT TAAAAGTTAT GCCAGCGGTG GCGTGCCCCC CGCATTGATG GGTATGGGGC
1561 CAGTACCTGC CACGCAAAAA GCGTTACAAC TGGCGGGGCT GCAACTGGCG GATATTGATC
1621 TCATTGAGGC TAATGAAGCA TTTGCTGCAC AGTTCCTTGC CGTTGGGAAA AACCTGGGCT
1681 TTGATTCTGA GAAAGTGAAT GTCAACGGCG GGGCCATCGC GCTCGGGCAT CCTATCGGTG
1741 CCAGTGGTGC TCGTATTCTG GTCACACTAT TACATGCCAT GCAGGCACGC GATAAAACGC
1801 TGGGGCTGGC AACACTGTGC ATTGGCGGCG GTCAGGGAAT TGCGATGGTG ATTGAACGGT

Stop Acetoacetyl-CoA

Thiolase   Start HMG-CoA Synthase

1861 TGAATTAAGG AGGACAGCTA AATGAACTC TCAACTAAAC TTTGTTGGTG TGGTATTAAA
1921 GGAAGACTTA GGCCGCAAAA GCAACAACAA TTACACAATA CAACTTGCA AATGACTGAA
1981 CTAAAAAAAC AAAAGACCGC TGAACAAAAA ACCAGACCTC AAAATGTCGG TATTAAAGGT
2041 ATCCAAATTT ACATCCCAAC TCAATGTGTC AACCAATCTG AGCTAGAGAA ATTTGATGGC
2101 GTTCTCAAG GTAAATACAC AATTGGTCTG GGCCAAACCA ACATGTCTTT TGTCATGAC
2161 AGAGAAGATA TCTACTCGAT GTCCCTAACT GTTTTGTCTA AGTTGATCAA GAGTTACAAC
2221 ATCGACACCA ACAAATTTGG TAGATTAGAA GTCGGTACTG AAACCTCTGAT TGACAAGTCC
2281 AAGTCTGTCA AGTCTGTCTT GATGCAATTG TTTGGTGAAA AACTGACGT CGAAGGTATT
2341 GACACGCTTA ATGCCTGTTA CGGTGGTACC AACGCGTTGT TCAACTCTTT GAACTGGATT
2401 GAATCTAACG CATGGGATGG TAGAGACGCC ATTGTAGTTT GCGGTGATAT TGCCATCTAC
2461 GATAAGGGTG CCGCAAGACC AACCGGTGGT GCCGGTACTG TTGCTATGTG GATCGGTCCT
2521 GATGCTCCAA TTGTATTTGA CTCTGTAAGA GCTTCTTACA TGGAACACGC CTACGATTTT
2581 TACAAGCCAG ATTTCAACCAG CGAATATCCT TACGTCGATG GTCATTTTTT ATTAACCTGT
2641 TACGTCAAGG CTCTTGATCA AGTTTACAAG AGTTATTCCA AGAAGGCTAT TTCTAAAGGG
2701 TTGGTTAGCG ATCCCCTGG TTCGGATGCT TTGAACGTTT TGAAATATTT CGACTACAAC
2761 GTTTTCCATG TTCCAACCTG TAAATTGGTC ACAAATCAT ACGGTAGATT ACTATATAAC
2821 GATTTCAAG CCAATCCTCA ATTGTTCCCA GAAGTTGACG CCGAATTAGC TACTCGCGAT
2881 TATGACGAAT CTTTAACCGA TAAGAACATT GAAAAAACTT TTGTTAATGT TGCTAAGCCA
2941 TTCCACAAAG AGAGAGTTGC CCAATCTTTG ATTGTTCCAA CAAACACAGG TAACATGTAC
3001 ACCGCATCTG TTTATGCCGC CTTTGCATCT CTATTAACT ATGTTGGATC TGACGACTTA
3061 CAAGGCAAGC GTGTTGGTTT ATTTTCTTAC GGTTCGGTT TAGCTGCATC TCTATATTCT
3121 TGCAAAATTG TTGGTGACGT CCAACATATT ATCAAGGAAT TAGATATTAC TAACAAATTA
3181 GCCAAGAGAA TCACCGAAAC TCCAAAGGAT TACGAAGCTG CCATCGAATT GAGAGAAAAT
3241 GCCCATTTGA AGAAGAACTT CAAACCTCAA GGTTCCATTG AGCATTTGCA AAGTGGTGTT

Stop HMG-CoA synthase 

3301 TACTACTTGA CCAACATCGA TGACAAATTT AGAAGATCTT ACGATGTTAA AAAATAAGGA

RBS

Start Truncated HMG-CoA Reductase



5 3361 GGATTACACT ATGGTTTTTAA CCAATAAAAC AGTCATTTCT GGATCGAAAAG TCAAAAAGTTT
3421 ATCATCTGCG CAATCGAGCT CATCAGGACC TTCATCATCT AGTGAGGAAG ATGATTCCCG
3481 CGATATTGAA AGCTTGGATA AGAAAATACG TCCTTTAGAA GAATTAGAAG CATTATTAAG
3541 TAGTGGAAT ACAAACAAT TGAAGAACA AGAGGTCGCT GCCTTGGTTA TTCACGGTAA
3601 GTTACCTTTG TACGCTTTGG AGAAAAAATT AGGTGATACT ACGAGAGCGG TTGCGGTACG
10 3661 TAGGAAGGCT CTTTCAATTT TGGCAGAAGC TCCTGTATTA GCATCTGATC GTTTACCATA
3721 TAAAAATTAT GACTACGACC GCGTATTTGG CGCTTGTTGT GAAAATGTTA TAGGTTACAT
3781 GCCTTTGCCC GTTGGTGTTA TAGGCCCTT GGTATCGAT GGTACATCTT ATCATATACC
3841 AATGGCAACT ACAGAGGGTT GTTTGGTAGC TTCTGCCATG CGTGGCTGTA AGGCAATCAA
3901 TGCTGGCGGT GGTGCAACAA CTGTTTTAAC TAAGGATGGT ATGACAAGAG GCCCAGTAGT
3961 CCGTTTCCCA ACTTTGAAAA GATCTGGTGC CTGTAAGATA TGGTTAGACT CAGAAGAGGG
15 4021 ACAAACGCA ATTAATAAAG CTTTTAACTC TACATCAAGA TTTGCACGTC TGCAACATAT
4081 TCAAACCTGT CTAGCAGGAG ATTTACTCTT CATGAGATTT AGAACAATA CTGGTGACGC
4141 AATGGGTATG AATATGATTT CTAAAGGTGT CGAATACTCA TTAAAGCAAA TGGTAGAAGA
4201 GTATGGCTGG GAAGATATGG AGGTGTCTC CGTTTCTGGT AACTACTGTA CCGACAAAAA
4261 ACCAGCTGCC ATCAACTGGA TCGAAGGTCG TGGTAAGAGT GTCGTCGCAG AAGCTACTAT
20 4321 TCCTGGTGAT GTTGTCAGAA AAGTGTTAAA AAGTGATGTT TCCGCATTGG TTGAGTTGAA
4381 CATTGCTAAG AATTTGGTTG GATCTGCAAT GGCTGGGTCT GTTGGTGGAT TTAACGCACA
4441 TGCAGCTAAT TTAGTGACAG CTGTTTTCTT GGCATTAGGA CAAGATCCTG CACAAAATGT
4501 TGAAAGTTCC AACTGTATAA CATTGATGAA AGAAGTGGAC GGTGATTTGA GAATTTCCGT
4561 ATCCATGCCA TCCATCGAAG TAGGTACCAT CGGTGGTGGT ACTGTTCTAG AACCACAAGG
25 4621 TGCCATGTTG GACTTATTAG GTGTAAGAGG CCCGCATGCT ACCGCTCCTG GTACCAACGC
4681 ACGTCAATTA GCAAGAATAG TTGCCTGTGC CGTCTTGGCA GGTGAATTAT CCTTATGTGC
4741 TGCCCTAGCA GCCGGCCATT TGGTTCAAAG TCATATGACC CACAACAGGA AACCTGCTGA
4801 ACCAACAAAA CCTAACAAAT TGGACGCCAC TGATATAAAT CGTTTGAAAG ATGGGTCCGT

Stop Truncated

HMG-CoA Reductase



RBS



Start

30 4861 CACCTGCATT AAATCCTAAG TCGACCTGCA GTAGGAGGAA TTAACCATGT CATTACCGTT

Mevalonate Kinase

35 4921 CTTAACTTCT GCACCGGGAA AGGTTATTAT TTTTGGTGAA CACTCTGCTG TGTACAACAA
4981 GCCTGCCGTC GCTGCTAGTG TGTCTGCGTT GAGAACCTAC CTGCTAATAA GCGAGTCATC
5041 TGCACCAGAT ACTATTGAAT TGGACTTCCC GGACATTAGC TTAAATCATA AGTGGTCCAT

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5101 CAATGATTTTC AATGCCATCA CCGAGGATCA AGTAAACTCC CAAAAATTGG CCAAGGCTCA
5161 ACAAGCCACC GATGGCTTGT CTCAGGAACT CGTTAGTCTT TTGGATCCGT TGTTAGCTCA
5221 ACTATCCGAA TCCTTCCACT ACCATGCAGC GTTTTGTFTT CTGTATATGT TTGTTTGCCT
5281 ATGCCCCCAT GCCAAGAATA TTAAGTTTTT TTTAAAGTCT ACTTTACCCA TCGGTGCTGG
5341 GTTGGGCTCA AGCGCCTCTA TTTCTGTATC ACTGGCCTTA GCTATGGCCT ACTTGGGGGG
5401 GTTAATAGGA TCTAATGACT TGGAAAAGCT GTCAGAAAAC GATAAGCATA TAGTGAATCA
5461 ATGGGCCTTC ATAGGTGAAA AGTGTATTCA CGGTACCCCT TCAGGAATAG ATAACGCTGT
5521 GGCCACTTAT GGTAATGCCC TGCTATTTGA AAAAGACTCA CATAATGGAA CAATAAACAC
5581 AAACAATTTT AAGTTCTTAG ATGATTTCCC AGCCATTCCA ATGATCCTAA CCTATACTAG
5641 AATTCCAAGG TCTACAAAAG ATCTTGTTGC TCGCGTTCGT GTGTTGGTCA CCGAGAAATT
5701 TCCTGAAGTT ATGAAGCCAA TTCTAGATGC CATGGGTGAA TGTGCCCTAC AAGGCTTAGA
5761 GATCATGACT AAGTTAAGTA AATGTAAAGG CACCGATGAC GAGGCTGTAG AAATAATAA
5821 TGAAGTGTAT GAACAACATAT TGAATTGAT AAGAATAAAT CATGGACTGC TTGTCTCAAT
5881 CGGTGTTTCT CATCCTGGAT TAGAACTTAT TAAAAATCTG AGCGATGATT TGAGAATTGG
5941 CTCCACAAAA CTTACCGGTG CTGGTGCGG CGGTTGCTCT TTGACTTTGT TACGAAGAGA
6001 CATTACTCAA GAGCAAATTG ACAGCTTCAA AAAGAAATTG CAAGATGATT TTAGTTACGA
6061 GACATTTGAA ACAGACTTGG GTGGGACTGG CTGCTGTTTG TTAAGCGCAA AAAATTTGAA
6121 TAAAGATCTT AAAATCAAAT CCCTAGTATT CCAATTATTT GAAAATAAAA CTACCACAAA

Stop Mevalonate Kinase →
6181 GCAACAAATT GACGATCTAT TATTGCCAGG AAACACGAAT TTACCATGGA CTTCATAGGA
RBS

→ Start Phosphomevalonate Kinase
6241 GGCAGATCAA ATGTCAGAGT TGAGAGCCTT CAGTGCCCCA GGGAAAGCGT TACTAGCTGG
6301 TGGATATTTA GTTTTATAGATA CAAAATATGA AGCATTGTGA GTCGGATTAT CGGCAAGAAT
6361 GCATGCTGTA GCCCATCCTT ACGGTTTCATT GCAAGGGTCT GATAAGTTTG AAGTGCCTGT
6421 GAAAAGTAAA CAATTTAAAG ATGGGGAGTG GCTGTACCAT ATAAGTCCTA AAAGTGGCTT
6481 CATTCTGTT TCGATAGGCG GATCTAAGAA CCCTTTCATT GAAAAAGTTA TCGCTAACGT
6541 ATTTAGCTAC TTAAACCTA ACATGGACGA CTAAGTCAAT AGAACTTGT TCGTTATTGA
6601 TATTTTCTCT GATGATGCCT ACCATTCTCA GGAGGATAGC GTTACCGAAC ATCGTGGCAA
6661 CAGAAGATTG AGTTTTTCATT CGCACAGAAT TGAAGAAGTT CCCAAAACAG GGCTGGGCTC
6721 CTCGGCAGGT TTAGTCACAG TTTTAACTAC AGCTTTGGCC TCCTTTTTTG TATCGGACCT
6781 GGAAAATAAT GTAGACAAAT ATAGAGAAGT TATTCATAAT TTAGCACAAG TTGCTCATTG
6841 TCAAGCTCAG GGTAATTTG GAAGCGGGTT TGATGTAGCG GCGGCAGCAT ATGGATCTAT
6901 CAGATATAGA AGATTCCCAC CCGCATTAACT CTCTAATTTG CCAGATATTG GAAGTGCTAC
6961 TTACGGCAGT AAAGTGGCGC ATTTGGTTGA TGAAGAAGAC TGGAATATTA CGATTAAAAG

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7021 TAACCATTTA CCTTCGGGAT TAACTTTATG GATGGGCGAT ATTAAGAATG GTTCAGAAAC
7081 AGTAAACTG GTCCAGAAGG TAAAAAATTG GTATGATTTCG CATATGCCAG AAAGCTTGAA
7141 AATATATACA GAACTCGATC ATGCAAATTC TAGATTTATG GATGGACTAT CTAAACTAGA
7201 TCGCTTACAC GAGACTCATG ACGATTACAG CGATCAGATA TTTGAGTCTC TTGAGAGGAA
7261 TGA CTGTACC TGTCAAAAGT ATCCTGAAAT CACAGAAGTT AGAGATGCAG TTGCCACAAT
7321 TAGACGTTCC TTTAGAAAAA TAACTAAAGA ATCTGGTGCC GATATCGAAC CTCCCGTACA
7381 AACTAGCTTA TTGGATGATT GCCAGACCTT AAAAGGAGTT CTTACTTGCT TAATACCTGG
7441 TGCTGGTGGT TATGACGCCA TTGCAGTGAT TACTAAGCAA GATGTTGATC TTAGGGCTCA
7501 AACCGCTAAT GACAAAAGAT TTTCTAAGGT TCAATGGCTG GATGTAAGTC AGGCTGACTG

Stop Phosphomevalonate Kinase

7561 GGGTGT TAGG AAAGAAAAAG ATCCGGAAAC TTATCTTGAT AAATAGGAGG TAATACTCAT
RBS

Start Mevalonate Pyrophosphate Decarboxylase

7621 GACCGTTTAC ACAGCATCCG TTACCGCACC CGTCAACATC GCAACCCTTA AGTATTGGGG
7681 GAAAAGGGAC ACGAAGTTGA ATCTGCCCAC CAATTCGTCC ATATCAGTGA CTTTATCGCA
7741 AGATGACCTC AGAACGTTGA CCTCTGCGGC TACTGCACCT GAGTTTGAAC GCGACACTTT
7801 GTGGTTAAAT GGAGAACCAC ACAGCATCGA CAATGAAAGA ACTCAAAATT GTCTGCGCGA
7861 CCTACGCCAA TTAAGAAAGG AAATGGAATC GAAGGACGCC TCATTGCCCA CATTATCTCA
7921 ATGGAAACTC CACATTGTCT CCGAAAATAA CTTTCCTACA GCAGCTGGTT TAGCTTCCTC
7981 CGCTGCTGGC TTTGCTGCAT TGGTCTCTGC AATTGCTAAG TTATACCAAT TACCACAGTC
8041 AACTTCAGAA ATATCTAGAA TAGCAAGAAA GGGGTCTGGT TCAGCTTGTA GATCGTTGTT
8101 TGGCGGATAC GTGGCCTGGG AAATGGGAAA AGCTGAAGAT GGT CATGATT CCATGGCAGT
8161 ACAAATCGCA GACAGCTCTG ACTGGCCTCA GATGAAAGCT TGTGTCCTAG TTGTCAGCGA
8221 TATTAAAAAG GATGTGAGTT CCACTCAGGG TATGCAATTG ACCGTGGCAA CCTCCGAAC
8281 ATTTAAAGAA AGAATTGAAC ATGTCGTACC AAAGAGATTT GAAGTCATGC GTAAAGCCAT
8341 TGTTGAAAAA GATTTGCGCA CCTTTGCAAA GGAAACAATG ATGGATTCCA ACTCTTTCCA
8401 TGCCACATGT TTGGACTCTT TCCCTCCAAT ATTCTACATG AATGACACTT CCAAGCGTAT
8461 CATCAGTTGG TGCCACACCA TTAATCAGTT TTACGGAGAA ACAATCGTTG CATAACGTT
8521 TGATGCAGGT CCAAATGCTG TGTTGTACTA CTTAGCTGAA AATGAGTCGA AACTCTTTGC
8581 ATTTATCTAT AAATTGTTTG GCTCTGTTCC TGGATGGGAC AAGAAATTTA CTACTGAGCA
8641 GCTTGAGGCT TTCAACCATC AATTTGAATC ATCTAACTTT ACTGCACGTG AATTGGATCT
8701 TGAGTTGCAA AAGGATGTTG CCAGAGTGAT TTAACTCAA GTCGGTTCAG GCCCACAAGA

Stop Mevalonate Pyrophosphate Decarboxylase

8761 AACAAACGAA TCTTTGATTG ACGCAAAGAC TGGTCTACCA AAGGAATAAC TGCAGGCATG

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└─▶ Strong ribosomal rrnB terminators

8821 CAAGCTTGGC TGTTTTGGCG GATGAGAGAA GATTTTCAGC CTGATACAGA TTAAATCAGA
8881 ACGCAGAAGC GGTCTGATAA AACAGAATTT GCCTGGCGGC AGTAGCGCGG TGGTCCCACC
5 8941 TGACCCCATG CCGAACTCAG AAGTGAAACG CCGTAGCGCC GATGGTAGTG TGGGGTCTCC
9001 CCATGCGAGA GTAGGGAAC TCCAGGCATC AAATAAAACG AAAGGCTCAG TCGAAAGACT
9061 GGGCCTTTCG TTTTATCTGT TGTTTGTCTG TGAACGCTCT CCTGAGTAGG ACAAATCCGC
9121 CGGGAGCGGA TTTGAACGTT GCGAAGCAAC GGCCCGGAGG GTGGCGGGCA GGACGCCCCG
9181 CATAAACTGC CAGGCATCAA ATTAAGCAGA AGGCCATCCT GACGGATGGC CTTTTTGCGT
10 9241 TTCTACAAAC TCT

SEQ ID NO 8 "MEVT" operon nucleotide sequence

P_{BAD} Promoter

15 1 GACGCTTTTT ATCGCAACTC TCTACTGTTT CTCCATACCC GTTTTTTTGG GCTAGCAGGA

RBS

61 GGAATTCACC ATGGTACCCG GGGATCCTCT AGAGTCGACT AGGAGGAATA TAAATGAAA

20 Start Acetoacetyl-CoA thiolase

121 AATTGTGTCA TCGTCAGTGC GGTACGTACT GCTATCGGTA GTTTTAACGG TTCACTCGCT

181 TCCACCAGCG CCATCGACCT GGGGGCGACA GTAATTAAAG CCGCCATTGA ACGTGCAAAA

241 ATCGATTAC AACACGTTGA TGAAGTGATT ATGGGTAACG TGTTACAAGC CGGGCTGGGG

25 301 CAAAATCCGG CGCGTCAGGC ACTGTTAAAA AGCGGGCTGG CAGAAACGGT GTGCGGATTC

361 ACGGTCAATA AAGTATGTGG TTCGGGTCTT AAAAGTGTGG CGCTTGCCGC CCAGGCCATT

421 CAGGCAGGTC AGGCGCAGAG CATTGTGGCG GGGGGTATGG AAAATATGAG TTTAGCCCCC

481 TACTTACTCG ATGCAAAAGC ACGCTCTGGT TATCGTCTTG GAGACGGACA GGTTTATGAC

541 GTAATCCTGC GCGATGGCCT GATGTGCGCC ACCCATGGTT ATCATATGGG GATTACCGCC

30 601 GAAAACGTGG CTAAAGAGTA CGGAATTACC CGTGAAATGC AGGATGAACT GGCGCTACAT

661 TCACAGCGTA AAGCGGCAGC CGCAATTGAG TCCGGTGCTT TTACAGCCGA AATCGTCCCC

721 GTAAATGTTG TCACTCGAAA GAAAACCTTC GTCTTCAGTC AAGACGAATT CCCGAAAAGC

781 AATTCAACGG CTGAAGCGTT AGGTGCATTG CGCCCGGCCT TCGATAAAGC AGGAACAGTC

841 ACCGCTGGGA ACGCGTCTGG TATTAACGAC GGTGCTGCCG CTCTGGTGAT TATGGAAGAA

35 901 TCTGCGGCGC TGGCAGCAGG CCTTACCCCC CTGGCTCGCA TTTAAAGTTA TGCCAGCGGT

961 GGCGTGCCCC CCGCATTGAT GGGTATGGGG CCAGTACCTG CCACGCAAAA AGCGTTACAA

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1021 CTGGCGGGGC TGCAACTGGC GGATATTGAT CTCATTGAGG CTAATGAAGC ATTTGCTGCA
1081 CAGTTCCTTG CCGTTGGGAA AAACCTGGGC TTTGATTCTG AGAAAGTGAA TGTC AACGGC
1141 GGGGCCATCG CGCTCGGGCA TCCTATCGGT GCCAGTGGTG CTCGTATTCT GTTCACACTA
1201 TTACATGCCA TGCAGGCACG CGATAAACG CTGGGGCTGG CAACACTGTG CATTGGCGGC

Stop Acetoacetyl-CoA Thiolase →

1261 GGT CAGGGAA TTGCGATGGT GATTGAACGG TTGAATTAAG GAGGACAGCT AAATGAAACT

RBS

Start

HMG-CoA Synthase

1321 CTCAACTAAA CTTTGTGGT GTGGTATTAA AGGAAGACTT AGGCCGCAAA AGCAACAACA
1381 ATTACACAAT ACAAACTTGC AAATGACTGA ACTAAAAAAA CAAAAGACCG CTGAACAAAA
1441 AACCAGACCT CAAAATGTCG GTATTAAAGG TATCCAAATT TACATCCCAA CTCAATGTGT
1501 CAACCAATCT GAGCTAGAGA AATTTGATGG CGTTTCTCAA GGTAAATACA CAATTGGTCT
1561 GGGCCAAACC AACATGTCTT TTGTCAATGA CAGAGAAGAT ATCTACTCGA TGTCCCTAAC
1621 TGTTTTGTCT AAGTTGATCA AGAGTTACAA CATCGACACC AACAAAATTG GTAGATTAGA
1681 AGTCGGTACT GAAACTCTGA TTGACAAGTC CAAGTCTGTC AAGTCTGTCT TGATGCAATT
1741 GTTTGGTGAA AACACTGACG TCGAAGGTAT TGACACGCTT AATGCCTGTT ACGGTGGTAC
1801 CAACGCGTTG TTCAACTCTT TGAAGGTAT TGAATCTAAC GCATGGGATG GTAGAGACGC
1861 CATTGTAGTT TGCGGTGATA TTGCCATCTA CGATAAGGGT GCCGCAAGAC CAACCGGTGG
1921 TGCCGGTACT GTTGCTATGT GGATCGGTCC TGATGCTCCA ATTGTATTTG ACTCTGTAAG
1981 AGCTTCTTAC ATGGAACACG CCTACGATTT TTACAAGCCA GATTTACCA GCGAATATCC
2041 TTACGTCGAT GGTCATTTTT CATTAAGTTG TTACGTCAAG GCTCTTGATC AAGTTTACAA
2101 GAGTTATTCC AAGAAGGCTA TTTCTAAAGG GTTGGTTAGC GATCCCGCTG GTTCGGATGC
2161 TTTGAACGTT TTGAAATATT TCGACTACAA CGTTTTCCAT GTTCCAACCT GTAAATTGGT
2221 CACAAAATCA TACGGTAGAT TACTATATAA CGATTTTCAGA GCCAATCCTC AATTGTTCCC
2281 AGAAGTTGAC GCCGAATTAG CTACTCGCGA TTATGACGAA TCTTTAACCG ATAAGAACAT
2341 TGAAAAAAT TTTGTTAATG TTGCTAAGCC ATTCCACAAA GAGAGAGTTG CCCAATCTTT
2401 GATTGTTCCA ACAAACACAG GTAACATGTA CACCGCATCT GTTTATGCCG CCTTTGCATC
2461 TCTATTAAAC TATGTTGGAT CTGACGACTT ACAAGGCAAG CGTGTGGTGT TATTTTCTTA
2521 CGGTTCCGGT TTAGCTGCAT CTCTATATTC TTGCAAAATT GTTGGTGACG TCCAACATAT
2581 TATCAAGGAA TTAGATATTA CTAACAAATT AGCCAAGAGA ATCACCGAAA CTCCAAGGA
2641 TTACGAAGCT GCCATCGAAT TGAGAGAAAA TGCCCATTTG AAGAAGAACT TCAAACCTCA
2701 AGGTTCCATT GAGCATTTGC AAAGTGGTGT TTAATACTTG ACCAACATCG ATGACAAATT

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Stop HMG-CoA synthase → | | → Start Truncated
2761 TAGAAGATCT TACGATGTTA AAAAATAAGG AGGATTACAC TATGGTTTTA ACCAATAAAA
RBS

HMG-CoA reductase

5 2821 CAGTCATTTT TGGATCGAAA GTCAAAAGTT TATCATCTGC GCAATCGAGC TCATCAGGAC
2881 CTTTCATCATC TAGTGAGGAA GATGATTCCC GCGATATTGA AAGCTTGGAT AAGAAAATAC
2941 GTCCTTTAGA AGAATTAGAA GCATTATTAA GTAGTGGAAT TACAAAACAA TTGAAGAACA
3001 AAGAGGTCGC TGCCTTGGTT ATTACCGGTA AGTTACCTTT GTACGCTTTG GAGAAAAAAT
3061 TAGGTGATAC TACGAGAGCG GTTGCAGTAC GTAGGAAGGC TCTTTCAATT TTGGCAGAAG
10 3121 CTCCTGTATT AGCATCTGAT CGTTTACCAT ATAAAAATTA TGACTACGAC CGCGTATTTG
3181 GCGCTTGTG TGAATATGTT ATAGGTTACA TGCCTTTGCC CGTTGGTGTG ATAGGCCCTT
3241 TGGTTATCGA TGGTACATCT TATCATATAC CAATGGCAAC TACAGAGGGT TGTGTTGGTAG
3301 CTTCTGCCAT GCGTGGCTGT AAGGCAATCA ATGCTGGCGG TGGTGCAACA ACTGTTTAA
3361 CTAAGGATGG TATGACAAGA GGCCAGTAG TCCGTTTCCC AACTTTGAAA AGATCTGGTG
15 3421 CCTGTAAGAT ATGGTTAGAC TCAGAAGAGG GACAAAACGC AATTAAAAAA GCTTTTAACT
3481 CTACATCAAG ATTTGCACGT CTGCAACATA TTCAAAGTTG TCTAGCAGGA GATTTACTCT
3541 TCATGAGATT TAGAACAAC ACTGGTGACG CAATGGGTAT GAATATGATT TCTAAAGGTG
3601 TCGAATACTC ATTAAAGCAA ATGGTAGAAG AGTATGGCTG GGAAGATATG GAGGTTGTCT
3661 CCGTTTCTGG TAACTACTGT ACCGACAAA AACCAGCTGC CATCAACTGG ATCGAAGGTC
20 3721 GTGTAAGAG TGTCGTCGCA GAAGCTACTA TTCCTGGTGA TGTGTCGAGA AAAGTGTTAA
3781 AAAGTGATGT TTCCGCATTG GTTGAGTTGA ACATTGCTAA GAATTTGGTT GGATCTGCAA
3841 TGGCTGGGTC TGTGTTGGGA TTAAACGCAC ATGCAGCTAA TTTAGTGACA GCTGTTTTCT
3901 TGGCATTAGG ACAAGATCCT GCACAAAATG TTGAAAGTTC CAACTGTATA ACATTGATGA
3961 AAGAAGTGGA CGGTGATTTG AGAATTTCCG TATCCATGCC ATCCATCGAA GTAGGTACCA
25 4021 TCGGTGGTGG TACTGTTCTA GAACCACAAG GTGCCATGTT GGAATTATTA GGTGTAAGAG
4081 GCCCGCATGC TACCGCTCCT GGTACCAACG CACGTCAATT AGCAAGAATA GTTGCCTGTG
4141 CCGTCTTGGC AGGTGAATTA TCCTTATGTG CTGCCCTAGC AGCCGGCCAT TTGGTTCAAA
4201 GTCATATGAC CCACAACAGG AAACCTGCTG AACCAACAAA ACCTAACAAT TTGGACGCCA

30 Stop Truncated HMG-CoA Reductase → |
4261 CTGATATAAA TCGTTTGAAA GATGGGTCCG TCACCTGCAT TAAATCCTAA GTCGACCTGC

35 | → Strong ribosomal rrnB terminators
4321 AGGCATGCAA GCTTGGCTGT TTTGGCGGAT GAGAGAAGAT TTTCAGCCTG ATACAGATTA
4381 AATCAGAACG CAGAAGCGGT CTGATAAAAC AGAATTTGCC TGGCGGCAGT AGCGCGGTGG

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4441 TCCCACCTGA CCCCATGCCG AACTCAGAAG TGAAACGCCG TAGCGCCGAT GGTAGTGTGG
4501 GGTCTCCCCA TGCAGAGTA GGGAAGTACC AGGCATCAAA TAAAACGAAA GGCTCAGTCG
4561 AAAGACTGGG CCTTTCGTTT TATCTGTTGT TTGTCGGTGA ACGCTCTCCT GAGTAGGACA
4621 AATCCGCCCG GAGCGGATTT GAACGTTGCG AAGCAACGGC CCGGAGGGTG GCGGGCAGGA
5 4681 CGCCCGCCAT AACTGCCAG GCATCAAATT AAGCAGAAGG CCATCCTGAC GGATGGCCTT
4741 TTTGCGTTTC TACAACTCT

SEQ ID NO 9 "MEVB" operon nucleotide sequence

Lac Promoter

1 GCGCAACGCA ATTAATGTGA GTTAGCTCAC TCATTAGGCA CCCAGGCTT TACACTTTAT

61 GCTTCCGGCT CGTATGTTGT GTGGAATTGT GAGCGGATAA CAATTCACA CAGGAAACAG

121 CTATGACCAT GATTACGCCA AGCGCGCAAT TAACCCTCAC TAAAGGGAAC AAAAGCTGGG

181 TACCGGGCCC CCCCTCGAGG TCGACGGTAT CGATAAGCTT GATATCGAAT TCCTGCAGTA

RBS



Start Mevalonate Kinase

241 GGAGGAATTA ACCATGTCAT TACCGTTCTT AACTTCTGCA CCGGGAAGG TTATTATTTT

301 TGGTGAACAC TCTGCTGTGT ACAACAAGCC TGCCGTCGCT GCTAGTGTGT CTGCGTTGAG

361 AACCTACCTG CTAATAAGCG AGTCATCTGC ACCAGATACT ATTGAATTGG ACTTCCCGGA

421 CATTAGCTTT AATCATAAGT GGTCCATCAA TGATTTCAAT GCCATCACCG AGGATCAAGT

481 AAACCTCCAA AAATTGGCCA AGGCTCAACA AGCCACCGAT GGCTTGCTCTC AGGAACTCGT

541 TAGTCTTTTG GATCCGTTGT TAGCTCAACT ATCCGAATCC TTCCACTACC ATGCAGCGTT

601 TTGTTTCCTG TATATGTTTG TTTGCCTATG CCCCCATGCC AAGAATATTA AGTTTTCTTT

661 AAAGTCTACT TTACCCATCG GTGCTGGGTT GGGCTCAAGC GCCTCTATTT CTGTATCACT

721 GGCCTTAGCT ATGGCCTACT TGGGGGGGTT AATAGGATCT AATGACTTGG AAAAGCTGTC

781 AGAAAACGAT AAGCATATAG TGAATCAATG GGCCTTCATA GGTGAAAAGT GTATTCACGG

841 TACCCCTTCA GGAATAGATA ACGCTGTGGC CACTTATGGT AATGCCCTGC TATTTGAAAA

901 AGACTCACAT AATGGAACAA TAAACACAAA CAATTTTAAG TTCTTAGATG ATTTCCCAGC

961 CATTCCAATG ATCCTAACCT AACTAGAAAT TCCAAGGTCT ACAAAGATC TTGTTGCTCG

1021 CGTTCGTGTG TTGGTCACCG AGAAATTTCC TGAAGTTATG AAGCCAATTC TAGATGCCAT

1081 GGGTGAATGT GCCCTACAAG GCTTAGAGAT CATGACTAAG TTAAGTAAAT GTAAAGGCAC

1141 CGATGACGAG GCTGTAGAAA CTAATAATGA ACTGTATGAA CAACTATTGG AATTGATAAG

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1201 AATAAATCAT GGACTGCTTG TCTCAATCGG TGTTCCTCAT CCTGGATTAG AACTTATTAA
1261 AAATCTGAGC GATGATTTGA GAATTGGCTC CACAAAACCTT ACCGGTGCTG GTGGCGGCGG
1321 TTGCTCTTTG ACTTTGTTAC GAAGAGACAT TACTCAAGAG CAAATTGACA GCTTCAAAAA
1381 GAAATTGCAA GATGATTTTA GTTACGAGAC ATTTGAAACA GACTTGGGTG GGACTGGCTG
1441 CTGTTTGTTA AGCGCAAAAA ATTTGAATAA AGATCTTAAA ATCAAATCCC TAGTATTCCA
1501 ATTATTTGAA AATAAAACTA CCACAAAGCA ACAAATTGAC GATCTATTAT TGCCAGGAAA

Stop Mevalonate Kinase →
1561 CACGAATTTA CCATGGACTT CATAGGAGGC AGATCAAATG TCAGAGTTGA GAGCCTTCAG
RBS

Kinase
1621 TGCCCCAGGG AAAGCGTTAC TAGCTGGTGG ATATTTAGTT TTAGATACAA AATATGAAGC
1681 ATTTGTAGTC GGATTATCGG CAAGAATGCA TGCTGTAGCC CATCCTTACG GTTCATTGCA
1741 AGGGTCTGAT AAGTTTGAAG TCGTGTGAA AAGTAAACAA TTAAAGATG GGGAGTGGCT
1801 GTACCATATA AGTCCTAAAA GTGGCTTCAT TCCTGTTTCG ATAGGCGGAT CTAAGAACCC
1861 TTTCATTGAA AAAGTTATCG CTAACGTATT TAGCTACTTT AAACCTAACA TGGACGACTA
1921 CTGCAATAGA AACTTGTTTCG TTATTGATAT TTTCTCTGAT GATGCCTACC ATTCTCAGGA
1981 GGATAGCGTT ACCGAACATC GTGGCAACAG AAGATTGAGT TTTCATTTCG ACAGAATTGA
2041 AGAAGTTCCC AAAACAGGGC TGGGCTCCTC GGCAGGTTTA GTCACAGTTT TAACTACAGC
2101 TTTGGCCTCC TTTTGTGTAT CGGACCTGGA AAATAATGTA GACAAATATA GAGAAGTTAT
2161 TCATAATTTA GCACAAGTTG CTCATTGTCA AGCTCAGGGT AAAATTGGAA GCGGGTTTGA
2221 TGTAGCGGCG GCAGCATATG GATCTATCAG ATATAGAAGA TTCCCACCCG CATTAACTCTC
2281 TAATTTGCCA GATATTGGAA GTGCTACTTA CGGCAGTAAA CTGGCGCATT TGGTTGATGA
2341 AGAAGACTGG AATATTACGA TTAAGAGTAA CCATTTACCT TCGGGATTAA CTTTATGGAT
2401 GGGCGATATT AAGAATGGTT CAGAAACAGT AAAACTGGTC CAGAAGGTAA AAAATTGGTA
2461 TGATTCGCAT ATGCCAGAAA GCTTGAAAAAT ATATACAGAA CTCGATCATG CAAATTCTAG
2521 ATTTATGGAT GGACTATCTA AACTAGATCG CTTACACGAG ACTCATGACG ATTACAGCGA
2581 TCAGATATTT GAGTCTCTTG AGAGGAATGA CTGTACCTGT CAAAAGTATC CTGAAATCAC
2641 AGAAGTTAGA GATGCAGTTG CCACAATTAG ACGTTCCTTT AGAAAAATAA CTAAAGAATC
2701 TGGTGCCGAT ATCGAACCTC CCGTACAAAC TAGCTTATTG GATGATTGCC AGACCTTAAA
2761 AGGAGTTCTT ACTTGCTTAA TACCTGGTGC TGGTGGTTAT GACGCCATTG CAGTGATTAC
2821 TAAGCAAGAT GTTGATCTTA GGGCTCAAAC CGCTAATGAC AAAAGATTTT CTAAGGTTCA

Stop Phosphomevalonate
2881 ATGGCTGGAT GTAACCTCAGG CTGACTGGGG TGTTAGGAAA GAAAAAGATC CGGAAACTTA

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Kinase → | | → Start Mevalonate Pyrophosphate
2941 TCTTGATAAA TAGGAGGTAA TACTCATGAC CGTTTACACA GCATCCGTTA CCGCACCCGT
RBS

Decarboxylase

5 3001 CAACATCGCA ACCCTTAAGT ATTGGGGGAA AAGGGACACG AAGTTGAATC TGCCACCAA
3061 TTCGTCCATA TCAGTGACTT TATCGCAAGA TGACCTCAGA ACGTTGACCT CTGCGGCTAC
3121 TGCACCTGAG TTTGAACGCG ACACTTTGTG GTTAAATGGA GAACCACACA GCATCGACAA
3181 TGAAAGAACT CAAAATTGTC TGC GCGACCT ACGCCAATTA AGAAAGGAAA TGGAATCGAA
3241 GGACGCCTCA TTGCCCACAT TATCTCAATG GAAACTCCAC ATTGTCTCCG AAAATAACTT
10 3301 TCCTACAGCA GCTGGTTTAG CTTCTCCGCG TGCTGGCTTT GCTGCATTGG TCTCTGCAAT
3361 TGCTAAGTTA TACCAATTAC CACAGTCAAC TTCAGAAATA TCTAGAATAG CAAGAAAGGG
3421 GTCTGGTTCA GCTTGTAGAT CGTTGTTTGG CGGATACGTG GCCTGGGAAA TGGGAAAAGC
3481 TGAAGATGGT CATGATTCCA TGGCAGTACA AATCGCAGAC AGCTCTGACT GGCCTCAGAT
3541 GAAAGCTTGT GTCCTAGTTG TCAGCGATAT TAAAAAGGAT GTGAGTTCCA CTCAGGGTAT
15 3601 GCAATTGACC GTGGCAACCT CCGAACTATT TAAAGAAAGA ATTGAACATG TCGTACCAAA
3661 GAGATTTGAA GTCATGCGTA AAGCCATTGT TGAAAAAGAT TTCGCCACCT TTGCAAAGGA
3721 AACAAATGATG GATTCCAAC TTTTCCATGC CACATGTTTG GACTCTTTCC CTCCAATATT
3781 CTACATGAAT GACACTTCCA AGCGTATCAT CAGTTGGTGC CACACCATTA ATCAGTTTTA
3841 CGGAGAAACA ATCGTTGCAT ACACGTTTGA TGCAGGTCCA AATGCTGTGT TGTACTACTT
20 3901 AGCTGAAAAT GAGTCGAAAC TCTTTGCATT TATCTATAAA TTGTTTGGCT CTGTTCTGG
3961 ATGGGACAAG AAATTTACTA CTGAGCAGCT TGAGGCTTTC AACCATCAAT TTGAATCATC
4021 TAACTTTACT GCACGTGAAT TGGATCTTGA GTTGCAAAAG GATGTTGCCA GAGTGATTTT
25 4081 AACTCAAGTC GGTTCAGGCC CACAAGAAAC AAACGAATCT TTGATTGACG CAAAGACTGG
Stop Mevalonate Pyrophosphate

Decarboxylase → |

4141 TCTACCAAAG GAATAACTGC AGCCCGGGG ATCCACTAGT TCTAGAGCGG CCGCCACCGC
4201 GGTGGAGCTC CAATTCGCCC TATAGTGAGT CGTATTACGC GCGCTCACTG GCCGTCGTTT
30 4261 TACAACGTCG TGA CTGGGAA AACCCTGGCG TTACCCAAC TAAATCGCCTT GCAGCACATC
4321 CCCCTTTTCG CAGCTGGCGT AATAGCGAAG AGGCCCGCAC CGATCGCCCT TCCCAACAGT
4381 TGCGCAGCCT GAATGGCGAA TGGA AATTGT AAGCGTTAAT ATTTTGTTAA AATTCGCGTT
4441 AAATTTTGT TAAATCAGCT CATTTTTTAA CCAATAGGCC GA

35 SEQ ID NO 10 Isopentyl pyrophosphate isomerase (*idi*) nucleotide sequence

1 ATGCAAACGG AACACGTCAT TTTATTGAAT GCACAGGGAG TTCCACGGG TACGCTGGAA

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61 AAGTATGCCG CACACACGGC AGACACCCGC TTACATCTCG CGTTCTCCAG TTGGCTGTTT
121 AATGCCAAAG GACAATTATT AGTTACCCGC CGCGCACTGA GCAAAAAAGC ATGGCCTGGC
181 GTGTGGACTA ACTCGGTTTG TGGGCACCCA CAACTGGGAG AAAGCAACGA AGACGCAGTG
241 ATCCGCCGTT GCCGTTATGA GCTTGGCGTG GAAATTACGC CTCCTGAATC TATCTATCCT
301 GACTTTCGCT ACCGCGCCAC CGATCCGAGT GGCATTGTGG AAAATGAAGT GTGTCCGGTA
361 TTTGCCGCAC GCACCACTAG TGC GTTACAG ATCAATGATG ATGAAGTGAT GGATTATCAA
421 TGGTGTGATT TAGCAGATGT ATTACACGGT ATTGATGCCA CGCCGTGGGC GTTCAGTCCG
481 TGGATGGTGA TGCAGGCGAC AAATCGCGAA GCCAGAAAAC GATTATCTGC ATTTACCCAG
541 CTTAAATAA

SEQ ID NO 11 Farnesyl pyrophosphate synthase (ispA) nucleotide sequence

1 ATGGACTTTC CGCAGCAACT CGAAGCCTGC GTTAAGCAGG CCAACCAGGC GCTGAGCCGT
61 TTTATCGCCC CACTGCCCTT TCAGAACT CCCGTGGTCG AAACCATGCA GTATGGCGCA
121 TTATTAGGTG GTAAGCGCCT GCGACCTTTC CTGGTTTATG CCACCGGTCA TATGTTCCGC
181 GTTAGCACAA ACACGCTGGA CGCACCCGCT GCCGCCGTTG AGTGTATCCA CGCTTACTCA
241 TTAATTCATG ATGATTTACC GGCAATGGAT GATGACGATC TCGTCGCGG TTTGCCAACC
301 TGCCATGTGA AGTTTGGCGA AGCAAACGCG ATTCTCGCTG GCGACGCTTT ACAACGCTG
361 GCGTTCCTGA TTTTAAGCGA TGCCGATATG CCGGAAGTGT CGGACGCGA CAGAATTTTCG
421 ATGATTTCTG AACTGGCGAG CGCCAGTGGT ATTGCCGGA TGTGCGGTGG TCAGGCATTA
481 GATTTAGACG CGGAAGGCAA ACACGTACCT CTGGACGCGC TTGAGCGTAT TCATCGTCAT
541 AAAACCGGCG CATTGATTCG CGCCGCCGTT CGCCTTGGTG CATTAAAGCG CGGAGATAAA
601 GGACGTCGTG CTCTGCCGGT ACTCGACAAG TATGCAGAGA GCATCGGCCT TGCCTTCCAG
661 GTTCAGGATG ACATCCTGGA TGTGGTGGGA GATACTGCAA CGTTGGGAAA ACGCCAGGGT
721 GCCGACCAGC AACTTGGTAA AAGTACCTAC CCTGCACTTC TGGGTCTTGA GCAAGCCCGG
781 AAGAAAGCCC GGGATCTGAT CGACGATGCC CGTCAGTCGC TGAAACAACCT GGCTGAACAG
841 TCACTCGATA CCTCGGCACT GGAAGCGCTA GCGGACTACA TCATCCAGCG TAATAAATAA

SEQ ID NO 12 "MBI" operon nucleotide sequence

Lac Promoter

1 GCGCAACGCA ATTAATGTGA GTTAGCTCAC TCATTAGGCA CCCCAGGCTT TACTCTTAT
61 GCTTCCGGCT CGTATGTTGT GTGGAATTGT GAGCGGATAA CAATTTTACA CAGGAAACAG
121 CTATGACCAT GATTACGCCA AGCGCGCAAT TAACCCTCAC TAAAGGGAAC AAAAGCTGGG

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181 TACCGGGCCC CCCCTCGAGG TCGACGGTAT CGATAAGCTT GATATCGAAT TCCTGCAGTA

5 RBS └─▶ Start Mevalonate Kinase
241 GGAGGAATTA ACCATGTCAT TACCGTTCTT AACTTCTGCA CCGGAAAGG TTATTATTTT

301 TGGTGAACAC TCTGCTGTGT ACAACAAGCC TGCCGTCGCT GCTAGTGTGT CTGCGTTGAG
361 AACCTACCTG CTAATAAGCG AGTCATCTGC ACCAGATACT ATTGAATTGG ACTTCCCGGA
10 421 CATTAGCTTT AATCATAAGT GGTCCATCAA TGATTTCAAT GCCATCACCG AGGATCAAGT
481 AAATCCCAA AAATTGGCCA AGGCTCAACA AGCCACCGAT GGCTTGTCTC AGGAACTCGT
541 TAGTCTTTTG GATCCGTTGT TAGCTCAACT ATCCGAATCC TTCCACTACC ATGCAGCGTT
601 TTGTTTCCTG TATATGTTTG TTTGCCTATG CCCCCATGCC AAGAATATTA AGTTTCTTTT
661 AAAGTCTACT TTACCCATCG GTGCTGGGTT GGGCTCAAGC GCCTCTATTT CTGTATCACT
15 721 GGCCTTAGCT ATGGCCTACT TGGGGGGGTT AATAGGATCT AATGACTTGG AAAAGCTGTC
781 AGAAAACGAT AAGCATATAG TGAATCAATG GGCCTTCATA GGTGAAAAGT GTATTCACGG
841 TACCCCTTCA GGAATAGATA ACGCTGTGGC CACTTATGGT AATGCCCTGC TATTTGAAAA
901 AGACTCACAT AATGGAACAA TAAACACAAA CAATTTTAAG TTCTTAGATG ATTTCCCAGC
961 CATTCCAATG ATCCTAACCT ATACTAGAAT TCCAAGGTCT ACAAAGATC TTGTTGCTCG
20 1021 CGTTCGTGTG TTGGTCACCG AGAAATTTCC TGAAGTTATG AAGCCAATTC TAGATGCCAT
1081 GGGTGAATGT GCCCTACAAG GCTTAGAGAT CATGACTAAG TTAAGTAAAT GTAAAGGCAC
1141 CGATGACGAG GCTGTAGAAA CTAATAATGA ACTGTATGAA CAACTATTGG AATTGATAAG
1201 AATAAATCAT GGACTGCTTG TCTCAATCGG TGTTTCTCAT CCTGGATTAG AACTTATTAA
1261 AAATCTGAGC GATGATTTGA GAATTGGCTC CACAAAACCT ACCGGTGCTG GTGGCGGCGG
25 1321 TTGCTCTTTG ACTTTGTTAC GAAGAGACAT TACTCAAGAG CAAATTGACA GCTTCAAAAA
1381 GAAATTGCAA GATGATTTTA GTTACGAGAC ATTTGAAACA GACTTGGGTG GGACTGGCTG
1441 CTGTTTGTTA AGCGCAAAAA ATTTGAATAA AGATCTTAAA ATCAAATCCC TAGTATTCCA
1501 ATTATTTGAA AATAAACTA CCACAAAGCA ACAAATTGAC GATCTATTAT TGCCAGGAAA

30 Stop Mevalonate Kinase └─▶ └─▶ Start Phosphomevalonate
1561 CACGAATTTA CCATGGACTT CATAGGAGGC AGATCAAATG TCAGAGTTGA GAGCCTTCAG
RBS

Kinase
1621 TGCCCCAGGG AAAGCGTTAC TAGCTGGTGG ATATTTAGTT TTAGATACAA AATATGAAGC
35 1681 ATTTGTAGTC GGATTATCGG CAAGAATGCA TGCTGTAGCC CATCCTTACG GTTCATTGCA
1741 AGGGTCTGAT AAGTTTGAAG TGCGTGTGAA AAGTAAACAA TTAAAGATG GGGAGTGGCT

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1801 GTACCATATA AGTCCTAAAA GTGGCTTCAT TCCTGTTTCG ATAGGCGGAT CTAAGAACCC
1861 TTTCATTGAA AAAGTTATCG CTAACGTATT TAGCTACTTT AAACCTAACA TGGACGACTA
1921 CTGCAATAGA AACTTGTTTCG TTATTGATAT TTTCTCTGAT GATGCCTACC ATTCTCAGGA
1981 GGATAGCGTT ACCGAACATC GTGGCAACAG AAGATTGAGT TTTCATTTCGC ACAGAATTGA
2041 AGAAGTTCCT AAAACAGGGC TGGGCTCCTC GGCAGGTTTA GTCACAGTTT TAACTACAGC
2101 TTTGGCCTCC TTTTGTGTAT CGGACCTGGA AAATAATGTA GACAAATATA GAGAAGTTAT
2161 TCATAATTTA GCACAAGTTG CTCATTGTCA AGCTCAGGGT AAAATTGGAA GCGGGTTTGA
2221 TGTAGCGGCG GCAGCATATG GATCTATCAG ATATAGAAGA TTCCCACCCG CATTAATCTC
2281 TAATTTGCCA GATATTGGAA GTGCTACTTA CGGCAGTAAA CTGGCGCATT TGGTTGATGA
2341 AGAAGACTGG AATATTACGA TTAAGAGTAA CCATTTACCT TCGGGATTAA CTTTATGGAT
2401 GGGCGATATT AAGATGGTTC CAGAAACAGT AAAACTGGTC CAGAAAGTAA AAAATTGGTA
2461 TGATTTCGCAT ATGCCAGAAA GCTTGAAAAT ATATACAGAA CTCGATCATG CAAATTCTAG
2521 ATTTATGGAT GGAATATCTA AACTAGATCG CTTACACGAG ACTCATGACG ATTACAGCGA
2581 TCAGATATTT GAGTCTCTTG AGAGGAATGA CTGTACCTGT CAAAAGTATC CTGAAATCAC
2641 AGAAGTTAGA GATGCAGTTG CCACAATTAG ACGTTCCTTT AGAAAAATAA CTAAAGAATC
2701 TGGTGCCGAT ATCGAACCTC CCGTACAAAC TAGCTTATTG GATGATTGCC AGACCTTAAA
2761 AGGAGTTCTT ACTTGCTTAA TACCTGGTGC TGGTGGTTAT GACGCCATTG CAGTGATTAC
2821 TAAGCAAGAT GTTGATCTTA GGGCTCAAAC CGCTAATGAC AAAAGATTTT CTAAGGTTCA

Stop Phosphomevalonate

2881 ATGGCTGGAT GTAACCTCAGG CTGACTGGGG TGTTAGGAAA GAAAAAGATC CGGAAACTTA

Kinase → TAGGAGGTAA TACTCATGAC → Start Mevalonate Pyrophosphate
2941 TCTTGATAAA TAGGAGGTAA TACTCATGAC CGTTTACACA GCATCCGTTA CCGCACCCGT
RBS

Decarboxylase

3001 CAACATCGCA ACCCTTAAGT ATTGGGGGAA AAGGGACACG AAGTTGAATC TGCCACCAA
3061 TTCGTCCATA TCAGTGACTT TATCGCAAGA TGACCTCAGA ACGTTGACCT CTGCGGCTAC
3121 TGCACCTGAG TTTGAACGCG AACTTTGTG GTTAAATGGA GAACCACACA GCATCGACAA
3181 TGAAAGAACT CAAAATTGTC TCGCGGACCT ACGCCAATTA AGAAAGGAAA TGAATCGAA
3241 GGACGCCTCA TTGCCACAT TATCTCAATG GAAACTCCAC ATTGTCTCCG AAAATAACTT
3301 TCCTACAGCA GCTGGTTTAG CTTCCTCCGC TGCTGGCTTT GCTGCATTGG TCTCTGCAAT
3361 TGCTAAGTTA TACCAATTAC CACAGTCAAC TTCAGAAATA TCTAGAATAG CAAGAAAGGG
3421 GTCTGGTTCA GCTTGTTAGT CGTTGTTTGG CGGATACGTG GCCTGGGAAA TGGGAAAAGC
3481 TGAAGATGGT CATGATTCCA TGGCAGTACA AATCGCAGAC AGCTCTGACT GGCCTCAGAT
3541 GAAAGCTTGT GTCCTAGTTG TCAGCGATAT TAAAAGGAT GTGAGTTCCA CTCAGGGTAT

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3601 GCAATTGACC GTGGCAACCT CCGAACTATT TAAAGAAAGA ATTGAACATG TCGTACCAAA
3661 GAGATTTGAA GTCATGCGTA AAGCCATTGT TGAAAAAGAT TTCGCCACCT TTGCAAAGGA
3721 AACAAATGATG GATTCCAACCT CTTTCCATGC CACATGTTTG GACTCTTTCC CTCCAATATT
3781 CTACATGAAT GACACTTCCA AGCGTATCAT CAGTTGGTGC CACACCATTA ATCAGTTTTA
3841 CGGAGAAACA ATCGTTGCAT ACACGTTTGA TGCAGGTCCA AATGCTGTGT TGTACTACTT
3901 AGCTGAAAAT GAGTCGAAAC TCTTTGCATT TATCTATAAA TTGTTTGGCT CTGTTCCCTGG
3961 ATGGGACAAG AAATTTACTA CTGAGCAGCT TGAGGCTTTC AACCATCAAT TTGAATCATC
4021 TAACTTTACT GCACGTGAAT TGGATCTTGA GTTGCAAAAG GATGTTGCCA GAGTGATTTT

Stop Mevalonate Pyrophosphate

4081 AACTCAAGTC GGTTCAGGCC CACAAGAAAC AAACGAATCT TTGATTGACG CAAAGACTGG

Decarboxylase → RBS → Start Isopentyl

4141 TCTACCAAAG GAATAACTGC AGCCCGGGAG GAGGATTACT ATATGCAAAC GGAACACGTC

Pyrophosphate Isomerase

4201 ATTTTATTGA ATGCACAGGG AGTTCCCACG GGTACGCTGG AAAAGTATGC CGCACACACG
4261 GCAGACACCC GCTTACATCT CGCGTTCTCC AGTTGGCTGT TTAATGCCAA AGGACAATTA
4321 TTAGTTACCC GCCGCGCACT GAGCAAAAAA GCATGGCCTG GCGTGTGGAC TAACTCGGTT
4381 TGTGGGCACC CAACTGCGG AGAAAGCAAC GAAGACGCAG TGATCCGCCG TTGCCGTTAT
4441 GAGCTTGGCG TGGAAATTAC GCCTCCTGAA TCTATCTATC CTGACTTTTCG CTACCGCGCC
4501 ACCGATCCGA GTGGCATTGT GGAAATGAA GTGTGTCCGG TATTTGCCGC ACGCACCCT
4561 AGTGCGTTAC AGATCAATGA TGATGAAGTG ATGGATTATC AATGGTGTGA TTTAGCAGAT
4621 GTATTACACG GTATTGATGC CACGCCGTGG GCGTTCAGTC CGTGGATGGT GATGCAGGCG

Stop Isopentyl Pyrophosphate Decarboxylase →

4681 ACAAATCGCG AAGCCAGAAA ACGATTATCT GCATTTACCC AGCTTAAATA ACCCGGGGGA
4741 TCCACTAGTT CTAGAGCGGC CGCCACCGCG GTGGAGCTCC AATTCGCCCT ATAGTGAGTC
4801 GTATTACGCG CGCTCACTGG CCGTCGTTTT ACAACGTCGT GACTGGGAAA ACCCTGGCGT
4861 TACCCAACTT AATCGCCTTG CAGCACATCC CCCTTTCGCC AGCTGGCGTA ATAGCGAAGA
4921 GGCCCGCACC GATCGCCCTT CCCAACAGTT GCGCAGCCTG AATGGCGAAT GGAAATTGTA
4981 AGCGTTAATA TTTTGTAAA ATTGCGGTTA AATTTTGTGTT AAATCAGCTC ATTTTAAAC
5041 CAATAGGCCG A

SEQ ID NO 13 "MBIS" operon nucleotide sequence

Lac Promoter

1 GCGCAACGCA ATTAATGTGA GTTAGCTCAC TCATTAGGCA CCCCAGGCTT TACACTTTAT
5
61 GCTTCCGGCT CGTATGTTGT GTGGAATTGT GAGCGGATAA CAATTTACACA CAGGAAACAG
121 CTATGACCAT GATTACGCCA AGCGCGCAAT TAACCCTCAC TAAAGGGAAC AAAAGCTGGG
10
181 TACCGGGCCC CCCCTCGAGG TCGACGGTAT CGATAAGCTT GATATCGAAT TCCTGCAGTA

RBS

Start Mevalonate Kinase

241 GGAGGAATTA ACCATGTCAT TACCGTTCTT AACTTCTGCA CCGGGAAAGG TTATTATTTT
15
301 TGGTGAACAC TCTGCTGTGT ACAACAAGCC TGCCGTCGCT GCTAGTGTGT CTGCGTTGAG
361 AACCTACCTG CTAATAAGCG AGTCATCTGC ACCAGATACT ATTGAATTGG ACTTCCCGGA
421 CATTAGCTTT AATCATAAGT GGTCCATCAA TGATTTCAAT GCCATCACCG AGGATCAAGT
481 AAATCCCAA AAATTGGCCA AGGCTCAACA AGCCACCGAT GGCTTGCTCTC AGGAACTCGT
541 TAGTCTTTTG GATCCGTTGT TAGCTCAACT ATCCGAATCC TTCCACTACC ATGCAGCGTT
20
601 TTGTTTCCTG TATATGTTTG TTTGCCTATG CCCCATGCC AAGAATATTA AGTTTCTTT
661 AAAGTCTACT TTACCCATCG GTGCTGGGTT GGGCTCAAGC GCCTCTATTT CTGTATCACT
721 GGCCTTAGCT ATGGCCTACT TGGGGGGGTT AATAGGATCT AATGACTTGG AAAAGCTGTC
781 AGAAAACGAT AAGCATATAG TGAATCAATG GGCCTTCATA GGTGAAAAGT GTATTACGG
841 TACCCCTTCA GGAATAGATA ACGCTGTGGC CACTTATGGT AATGCCCTGC TATTTGAAAA
25
901 AGACTCACAT AATGGAACAA TAAACACAAA CAATTTTAAG TTCTTAGATG ATTTCCCAGC
961 CATTCCAATG ATCCTAACCT AACTAGAAT TCCAAGGTCT ACAAAAGATC TTGTTGCTCG
1021 CGTTCGTGTG TTGGTCACCG AGAAATTTCC TGAAGTTATG AAGCCAATTC TAGATGCCAT
1081 GGGTGAATGT GCCCTACAAG GCTTAGAGAT CATGACTAAG TTAAGTAAAT GTAAAGGCAC
1141 CGATGACGAG GCTGTAGAAA CTAATAATGA ACTGTATGAA CAACTATTGG AATTGATAAG
30
1201 AATAAATCAT GGACTGCTTG TCTCAATCGG TGTTTCTCAT CCTGGATTAG AACTTATTAA
1261 AAATCTGAGC GATGATTTGA GAATTGGCTC CACAAAACCT ACCGGTGCTG GTGGCGGCGG
1321 TTGCTCTTTG ACTTTGTTAC GAAGAGACAT TACTCAAGAG CAAATTGACA GCTTCAAAAA
1381 GAAATTGCAA GATGATTTTA GTTACGAGAC ATTTGAAACA GACTTGGGTG GGACTGGCTG
1441 CTGTTTGTTA AGCGCAAAAA ATTTGAATAA AGATCTTAAA ATCAAATCCC TAGTATTCCA
35
1501 ATTATTTGAA AATAAACTA CCACAAAGCA ACAAATTGAC GATCTATTAT TGCCAGGAAA

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Stop Mevalonate Kinase → | | → Start Phosphomevalonate
1561 CACGAATTTA CCATGGACTT CATAGGAGGC AGATCAAATG TCAGAGTTGA GAGCCTTCAG
RBS

Kinase

5 1621 TGCCCCAGGG AAAGCGTTAC TAGCTGGTGG ATATTTAGTT TTAGATACAA AATATGAAGC
1681 ATTTGTAGTC GGATTATCGG CAAGAATGCA TGCTGTAGCC CATCCTTACG GTTCATTGCA
1741 AGGGTCTGAT AAGTTTGAAG TGGGTGTGAA AAGTAAACAA TTTAAAGATG GGGAGTGGCT
1801 GTACCATATA AGTCCTAAAA GTGGCTTCAT TCCTGTTTCG ATAGGCGGAT CTAAGAACCC
1861 TTTCATTGAA AAAGTTATCG CTAACGTATT TAGCTACTTT AAACCTAACA TGGACGACTA
10 1921 CTGCAATAGA AACTTGTTTCG TTATTGATAT TTTCTCTGAT GATGCCTACC ATTCTCAGGA
1981 GGATAGCGTT ACCGAACATC GTGGCAACAG AAGATTGAGT TTTCATTTCG ACAGAATTGA
2041 AGAAGTTCCC AAAACAGGGC TGGGCTCCTC GGCAGGTTTA GTCACAGTTT TAACTACAGC
2101 TTTGGCCTCC TTTTTTGTAT CGGACCTGGA AAATAATGTA GACAAATATA GAGAAGTTAT
2161 TCATAATTTA GCACAAGTTG CTCATTGTCA AGCTCAGGGT AAAATTGGAA GCGGGTTTGA
15 2221 TGTAGCGGCG GCAGCATATG GATCTATCAG ATATAGAAGA TTCCCACCCG CATTAATCTC
2281 TAATTTGCCA GATATTGGAA GTGCTACTTA CGGCAGTAAA CTGGCGCATT TGTTTGATGA
2341 AGAAGACTGG AATATTACGA TTAAAAGTAA CCATTTACCT TCGGGATTAA CTTTATGGAT
2401 GGGCGATATT AAGAATGGTT CAGAAACAGT AAAACTGGTC CAGAAGGTAA AAAATTGGTA
2461 TGATTTCGCAT ATGCCAGAAA GCTTGAAAAT ATATACAGAA CTCGATCATG CAAATTCTAG
20 2521 ATTTATGGAT GGAATATCTA AACTAGATCG CTTACACGAG ACTCATGACG ATTACAGCGA
2581 TCAGATATTT GAGTCTCTTG AGAGGAATGA CTGTACCTGT CAAAAGTATC CTGAAATCAC
2641 AGAAGTTAGA GATGCAGTTG CCACAATTAG ACGTTCCTTT AGAAAAATAA CTAAAGAATC
2701 TGGTGCCGAT ATCGAACCTC CCGTACAAAC TAGCTTATTG GATGATTGCC AGACCTTAAA
2761 AGGAGTTCTT ACTTGCTTAA TACCTGGTGC TGGTGGTTAT GACGCCATTG CAGTGATTAC
25 2821 TAAGCAAGAT GTTGATCTTA GGGCTCAAAC CGCTAATGAC AAAAGATTTT CTAAGGTTCA

Stop Phosphomevalonate

2881 ATGGCTGGAT GTAACTCAGG CTGACTGGGG TGTTAGGAAA GAAAAAGATC CGGAAACTTA

30 Kinase → | | → Start Mevalonate Pyrophosphate
2941 TCTTGATAAA TAGGAGGTAA TACTCATGAC CGTTTACACA GCATCCGTTA CCGCACCCGT
RBS

Decarboxylase

3001 CAACATCGCA ACCCTTAAGT ATTGGGGGAA AAGGGACACG AAGTTGAATC TGCCCCACAA
35 3061 TTCGTCCATA TCAGTGAAGT TATCGCAAGA TGACCTCAGA ACGTTGACCT CTGCGGCTAC
3121 TGCACCTGAG TTTGAACGCG ACACTTTGTG GTTAAATGGA GAACCACACA GCATCGACAA

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3181 TGAAAGAACT CAAAATTGTC TCGCGACCT ACGCCAATTA AGAAAGGAAA TGGAATCGAA
3241 GGACGCCTCA TTGCCACAT TATCTCAATG GAAACTCCAC ATTGTCTCCG AAAATAACTT
3301 TCCTACAGCA GCTGGTTTAG CTTCTCCGC TGCTGGCTTT GCTGCATTGG TCTCTGCAAT
3361 TGCTAAGTTA TACCAATTAC CACAGTCAAC TTCAGAAATA TCTAGAATAG CAAGAAAGGG
5 3421 GTCTGGTTCA GCTTGTAAGAT CGTTGTTTGG CGGATACGTG GCCTGGGAAA TGGGAAAAGC
3481 TGAAGATGGT CATGATTCCA TGGCAGTACA AATCGCAGAC AGCTCTGACT GGCCTCAGAT
3541 GAAAGCTTGT GTCCTAGTTG TCAGCGATAT TAAAAAGGAT GTGAGTTCCA CTCAGGGTAT
3601 GCAATTGACC GTGGCAACCT CCGAACTATT TAAAGAAAGA ATTGAACATG TCGTACCAAA
3661 GAGATTTGAA GTCATGCGTA AAGCCATTGT TGAAAAAGAT TTCGCCACCT TTGCAAAGGA
10 3721 AACAAATGATG GATTCCAACCT CTTTCCATGC CACATGTTTG GACTCTTTCC CTCCAATATT
3781 CTACATGAAT GACACTTCCA AGCGTATCAT CAGTTGGTGC CACACCATTA ATCAGTTTTA
3841 CGGAGAAACA ATCGTTGCAT ACACGTTTGA TGCAGGTCCA AATGCTGTGT TGTACTACTT
3901 AGCTGAAAAT GAGTCGAAAC TCTTTGCATT TATCTATAAA TTGTTTGGCT CTGTTCTCTGG
3961 ATGGGACAAG AAATTTACTA CTGAGCAGCT TGAGGCCTTC AACCATCAAT TTGAATCATC
15 4021 TAACTTTACT GCACGTGAAT TGGATCTTGA GTTGCAAAAG GATGTTGCCA GAGTGATTTT

Stop Mevalonate Pyrophosphate

4081 AACTCAAGTC GGTTCAGGCC CACAAGAAAC AAACGAATCT TTGATTGACG CAAAGACTGG
Decarboxylase → RBS → Start Isopentyl
4141 TCTACCAAAG GAATAACTGC AGCCCGGGAG GAGGATTACT ATATGCAAAC GGAACACGTC

Pyrophosphate Isomerase (*idi*)

4201 ATTTTATTGA ATGCACAGGG AGTTCCACG GGTACGCTGG AAAAGTATGC CGCACACACG
25 4261 GCAGACACCC GCTTACATCT CGCGTTCTCC AGTTGGCTGT TTAATGCCAA AGGACAATTA
4321 TTAGTTACCC GCCGCGCACT GAGCAAAAAA GCATGGCCTG GCGTGTGGAC TAACTCGGTT
4381 TGTGGGCACC CACAAC TGGG AGAAAGCAAC GAAGACGCAG TGATCCGCCG TTGCCGTTAT
4441 GAGCTTGGCG TGGAAATTAC GCCTCTGAA TCTATCTATC CTGACTTTTCG CTACCGCGCC
4501 ACCGATCCGA GTGGCATTGT GGAAAATGAA GTGTGTCCGG TATTTGCCGC ACGCACCCT
30 4561 AGTGCGTTAC AGATCAATGA TGATGAAGTG ATGGATTATC AATGGTGTGA TTTAGCAGAT
4621 GTATTACACG GTATTGATGC CACGCCGTGG GCGTTCAGTC CGTGGATGGT GATGCAGGCG

Stop: Isopentyl Pyrophosphate Decarboxylase →

4681 ACAATCGCG AAGCCAGAAA ACGATTATCT GCATTTACCC AGCTTAAATA ACCCGGGGGA

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RBS

└─▶ Start Farnesyl

4741 TCCACTAGTT CTAGAGCGGC CGCCACCGCG GAGGAGGAAT GAGTAATGGA CTTTCCGCAG

Pyrophosphate Synthase (*ispA*)

5 4801 CAACTCGAAG CCTGCGTTAA GCAGGCCAAC CAGGCGCTGA GCCGTTTTAT CGCCCCACTG
4861 CCCTTTCAGA ACACTCCCGT GGTGCAAACC ATGCAGTATG GCGCATTATT AGGTGGTAAG
4921 CGCCTGCGAC CTTTCCTGGT TTATGCCACC GGTCATATGT TCGGCGTTAG CACAAACACG
4981 CTGGACGCAC CCGCTGCCGC CGTTGAGTGT ATCCACGCTT ACTCATTAAT TCATGATGAT
5041 TTACCGGCAA TGGATGATGA CGATCTGCGT CGCGGTTTGC CAACCTGCCA TGTGAAGTTT
10 5101 GGCGAAGCAA ACGCGATTCT CGCTGGCGAC GCTTTACAAA CGCTGGCGTT CTCGATTTTA
5161 AGCGATGCCG ATATGCCGGA AGTGTGCGAC CGCGACAGAA TTTCGATGAT TTCTGAACTG
5221 GCGAGCGCCA GTGGTATTGC CGGAATGTGC GGTGGTCAGG CATTAGATTT AGACGCGGAA
5281 GGCAAACACG TACCTCTGGA CGCGCTTGAG CGTATTCATC GTCATAAAAC CGGCGCATTG
5341 ATTCGCGCCG CCGTTCGCCT TGGTGCATTA AGCGCCGAG ATAAAGGACG TCGTGCTCTG
15 5401 CCGGTACTCG ACAAGTATGC AGAGAGCATC GGCTTGCCT TCCAGGTTCA GGATGACATC
5461 CTGGATGTGG TGGGAGATAC TGCAACGTTG GGAAAACGCC AGGGTGCCGA CCAGCAACTT
5521 GGTAAGTA CCTACCCTGC ACTTCTGGGT CTTGAGCAAG CCCGGAAGAA AGCCCGGGAT
5581 CTGATCGACG ATGCCCGTCA GTCGCTGAAA CAACTGGCTG AACAGTCACT CGATACCTCG

Stop Farnesyl Pyrophosphate Synthase ─▶

20 5641 GCACTGGAAG CGCTAGCGGA CTACATCATC CAGCGTAATA AATAAGAGCT CCAATTCGCC
5701 CTATAGTGAG TCGTATTACG CGCGCTCACT GGCCGTCGTT TTACAACGTC GTGACTGGGA
5761 AAACCCTGGC GTTACCCAAC TTAATCGCCT TGCAGCACAT CCCCCTTTTCG CCAGCTGGCG
5821 TAATAGCGAA GAGGCCCGCA CCGATCGCCC TTCCAACAG TTGCGCAGCC TGAATGGCGA
25 5881 ATGGAAATTG TAAGCGTTAA TATTTTGTTA AAATTCGCGT TAAATTTTTCG TTAAATCAGC
5941 TCATTTTTTA ACCAATAGGC CGA

30

35